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Phenomena in Gases Excited by Radio Frequency Currents

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THE PATH OF A RIGID ELECTRON WHICH MOVES IN A MAGNETIC FIELD OF CONSTANT STRENGTH ROTATING WITH CONSTANT ANGULAR VELOCITY

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Abstract

Equations of motion of a rigid electron in a uniformly rotating magnetic field of constant strength rotating with a frequency $\omega/2\pi$ in the XZ plane are obtained. The reactions on the motion due to finite size, radiation from the electron and the field, and the variation of mass with velocity are neglected. If initially the velocity of the electron has components only along the X-axis or the Z-axis the path of the electron is a wavy curve inside an annular space whose axis is parallel to the Y-axis. If the initial velocity of the electron has components only along the Y-axis the path is a rather complicated type of spiral winding in the general direction of the Y-axis. It is found that a high frequency of rotation of the magnetic field, of the order of 10^6, such as may be produced by electron tube circuits, would not impart a great velocity to the electron.

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PHENOMENA IN GASES EXCITED BY RADIO FREQUENCY CURRENTS

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Abstract

The spectra from hydrogen, oxygen and air excited by currents of the frequency of the order of 10^6 alternations per second produced by an oscillating fifty-watt electron tube were photographed with a grating spectrograph in the spectral region from 5000 A to 3500 A. These spectra were found to be identical with the spectra of the same gas stimulated by sixty-cycle current of the same strength as the radio frequency current.

The potentials just sufficient to set up luminosity in hydrogen and in oxygen were measured for direct and radio frequency, i.e.,

frequencies from 10^5 to 10^7, current using electrode distances from 5 to 30 mm. and gas pressures from 1 to 5 mm. of mercury. For a specified gas pressure and electrode distance the direct potential and the maximum value of the radio frequency potentials were found to be the same. In the light of this result theoretical consideration indicated that the luminosity was started by collisions of electrons, rather than of gaseous ions, with the gas molecules.

The flashes of light from hydrogen, oxygen, argon and air in turn excited by damped radio frequency current were found to be each a train of radio frequency flashes when examined by means of a rotating mirror. For hydrogen and argon the first few flashes of the radio frequency train showed a predominance of the green and blue lines of the spectrum, the later flashes of the train showed a predominance of the red lines. This was ascribed to the fact that the maximum value of the current in the first few cycles of the damped discharge was much greater than in the subsequent cycles.

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THE BROADENING OF THE BALMER LINES OF HYDROGEN WITH PRESSURE

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Abstract

Spectrograms were taken of $H\beta$, HY and $H\delta$ of hydrogen excited by condensed discharges for gas pressures from 2 to 135 mm. of mercury. At the highest pressure the photographic widths of the lines were nearly 100 A.U. Throughout the series of pressures the intensity of the central portions of $H\beta$ was maintained sensibly constant. Assuming that the widening was caused by disturbance of the uniformity of the radiation due to collisions of the radiating particles (as proposed by others), the widening of the lines with pressure was calculated and found to be considerably less than that observed. This result indicated that the assumption was inadequate, and that the widening should be attributed to other causes such as the effect of the electrical fields, as investigated by Merton (Proc. Roy. Soc., 92, 322, 1915).

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